Standard for Dry Wells

Definition

An excavated pit filled with aggregate with a depth ranging from 3 to 12 feet which receives stormwater from primarily roof drainage.

Purpose

Dry well storage is used to enhance water quality by storing and infiltrating runoff, thus reducing the amount of water quality volume to be treated on a site.

This practice should be used primarily to reduce runoff from residential, commercial, institutional or industrial roof tops.

Conditions Where Practice Applies

A dry well is used to capture and store runoff from roof tops or areas with low sediment loading. The total contributing surface area should be a maximum of one acre or less per structure. The use of dry wells for stormwater control is applicable where soil is sufficiently permeable to allow a reasonable rate of infiltration. These devices are not applicable in large drainage areas, or areas where high pollutant or sediment loading without pretreatment is anticipated. If the runoff will contain toxic pollutants, infiltration facilities alone are not suitable because of the potential for groundwater contamination. Infiltration facilities **should not** be used in the following situations:

- In industrial areas and in commercial developments where petroleum products, herbicides, pesticides, or solvents may be loaded/unloaded, stored, or applied within the drainage area, especially locations with soluble heavy metals and toxic organics in the runoff;

- Where hazardous materials are expected to be present in greater than 'reportable quantities' as defined by the U.S. Environmental Protection Agency (EPA) in the Code of Federal Regulations (40 CFR 302.4); or

- For sites with high risks for spills of toxic materials, for example, gas stations and vehicle maintenance facilities.

- Soil beneath the structure does not have the necessary unsaturated void space

(volume) to store the entire volume of the design storm.

- In situations (especially residential) where dry well installation would create a significant risk for a wet basement.

Design Criteria

The minimum design storm shall be the 1.25 inch, two hour event (water quality design storm – Chapter 7). The volume of runoff shall be determined by USDA- NRCS TR55, TR20 or US Army COE HEC-1 hydrologic models. The runoff volume shall be based on impervious areas only. All impervious surfaces shall be assumed to be connected. Total drainage area is not to exceed 1 acre per structure.

An overflow system is required. The system must be connected to the nearest surface drainage facility of adequate hydraulic capacity to receive overflow during the design flood storm.

1. Soil Characteristics

Soil permeability must be sufficient to drain the entire volume of the water quality design storm within 72 hours. The soil infiltration rate shall be 0.5 inches per hour or greater. Suitable soil types include sand, sandy loam, loamy sand and gravel. Soils with high clay or silt content shall not be utilized for dry wells.

2. Depth to Ground Water or Bedrock

The minimum depth to the seasonal high water table or bedrock shall be three feet from the bottom of the structure. This shall provide for complete infiltration of the design storm and should prevent standing water, mounding and saturated surface conditions. Extended flooding of the structure may render it ineffective and result in anaerobic conditions, odor and water quality problems.

Installation

1. Provide enough access space for maintenance and monitoring activities. An observation well shall be installed in every dry well. This well will provide an indication of dewatering and a method for observing silt buildup requiring maintenance. The observation well should be routinely monitored.

2. A dry well should not be constructed or placed in service until the drainage area is stabilized.

3. Excavated material should be placed away from the excavated sides to prevent wall instability during excavation and backfilling. Large tree roots should be trimmed flush with the sides to prevent puncturing or tearing of filter fabric during installation. The side walls should be roughened where sheared and sealed by heavy equipment.

4. Vertically excavated trench walls may be difficult to maintain in areas where soil moisture is high or where soft cohesive or cohesionless soils predominate. These conditions may require laying back of the side slopes to maintain stability.

5. Care should be exercised to prevent natural or fill soils from mixing with drainage aggregate. All contaminated aggregate must be removed and replaced with clean material.

6. The bottom, sides and top of the well surface shall be lined with filter fabric with sufficiently small pore space to effectively prohibit the passage of the smallest soil particle found in the native soil profile. Only non-woven filter fabrics shall be used. Installation of the fabric shall provide sufficient length to cover the floor, sides and top of the aggregate. Fabric shall be wrapped over the top of the aggregate fill such that the fill shall be completely enclosed. The fabric shall be wrapped and tied with wire or nylon twine or otherwise tightly secured around the horizontal inflow pipe where the pipe protrudes through the fabric. Fabric shall be overlapped six inches in "shingle" fashion when more than one section is required to enclose the aggregate. The aggregate fill shall be placed to within 12 inches of the finished surface elevation, leaving sufficient depth for topsoil placement (in areas where surface stabilization is accomplished through the use of vegetation).

7. Drainage aggregate should be placed in lifts and compacted using plate compactors. A maximum loose lift thickness of 12 inches is recommended. The compaction process ensures fabric conformity to the excavation sides, reducing potential for soil piping and fabric clogging. Voids between the fabric and excavation sides due to boulders or other obstacles should be avoided. Natural soils should be placed in these voids during construction to ensure fabric conformity to excavation sides.

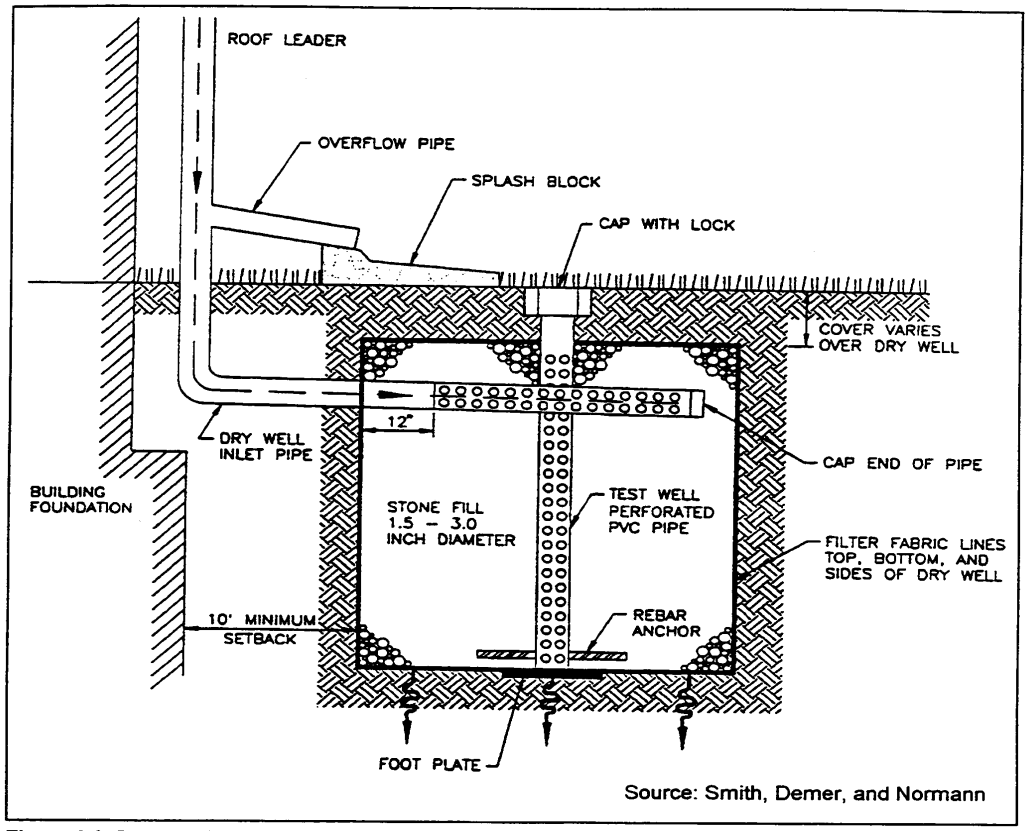

Figure 1. Dry Well detail

Dry Well Volume: (based on USDA-NRCS TR55: Urban Hydrology for Small Watersheds)

USDA-NRCS Runoff Parameters:

$$V_W = \frac{PA_{roof} + A_{ws}(P-Q)}{V_r} \qquad Q(ft) = \frac{0.083(P-0.2S)^2}{P + 0.8S} \qquad S = \frac{1000}{CN^*} - 10$$

Where:

- V_W = Volume of drywell (ft^3)
- P = 1.25 inch, 2 hour rainfall depth (ft)
- A_{roof} = area of roof (ft^2)
- A_{ws} = surface area above well, (ft^2)
- Q = runoff depth, (ft)
- V_r = void ratio of aggregate

* USDA-NRCS Runoff Curve Number, Technical Release 55

When the infiltration area above the well is small, the term $A_{ws}(P-Q)$ (net infiltration) will be negligible. Stormwater infiltrated through the bottom and sides of the well is not considered in determining the overall well volume in this method.

Considerations

Provisions should be made for excess runoff from larger volume storms to be conveyed away from the building to reduce the possibility of basement seepage. This may be accomplished through positive grading or a corrugated perforated conduit to a suitable outlet.

Operation and Maintenance

The dry well should be inspected monthly to ensure proper function. The water level in the test well should be the primary means of measuring infiltration. Corrective measures shall be taken if the structure fails to infiltrate the design storm event.